ACCESSION #: 9606050098

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Watts Bar Nuclear Plant - Unit 1

PAGE: 1 OF 7

DOCKET NUMBER: 05000390

TITLE: AUTOMATIC TURBINE AND REACTOR TRIPS DUE TO LOSS OF BOTH

MAIN FEEDWATER PUMPS

EVENT DATE: 04/28/96 LER #: 96-016-00 REPORT DATE: 05/27/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 072

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Walt Lewellyn, Compliance Licensing

Engineer TELEPHONE: (423) 365-8048

COMPONENT FAILURE DESCRIPTION:

CAUSE: D SYSTEM: SH COMPONENT: N/A MANUFACTURER: N/A

REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On April 28, 1996, at 1109 EST, WBN Unit 1 in Mode 1 experienced an automatic turbine trip from 72 percent power due to the trip of the Main Feedwater Pump (MFP) 1A, while MFP 1B was removed from service for maintenance. Trip logic was satisfied when MFP 1A tripped due to high condenser backpressure coincident with MFP 1B shutdown for Maintenance to repair a leaking valve. The primary side"responded as

expected. The Reactor Coolant System (RCS) performed as required, and the control rods all dropped and were confirmed to be fully inserted. The Auxiliary Feedwater pumps started as designed and flow was controlled to limit the cooldown.

The cause of the event was inadequate written instructions. System Operating Instruction (SOI)-2 & 3.01, "Condensate and Feedwater System," caused valves to be positioned such that MFP 1A tripped. When MFP 1B was removed from service, the turbine above seat drain valves were opened in accordance with the procedure to prevent condensate buildup above the steam supply valves. With the valves open, additional steam and condensate dumped directly to the condenser resulted in pressure buildup in MFP 1B condenser with only bypass cooling available. A contributing cause was the design of the vacuum line connection between Main Feedwater Pump Turbines (MFPTs). Difficulty in maintaining vacuum in an isolated condenser had been previously recognized and a modification to tie the pump turbine condensers to the main condenser had been issued and staged for implementation.

Corrective actions included (1) revising SOI-2 & 3.01 to remove the step that opens the above seat drain valves for the stop valves when shutting down a MFPT, (2) providing a vacuum line which directly connects the MFPT condenser to main condenser, and (3) revising the condenser low vacuum alarm setpoint to provide early warning prior to trip setpoint.

Power ascension was resumed after the MFPs were placed in service following the completion of the vacuum line modification.

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I. PLANT CONDITIONS:

WBN Unit 1 was in Mode 1 at approximately 71.5 percent power

operation, with the Reactor Coolant System temperature and pressure

of 561 degrees F and 2235 psi, respectively.

II. DESCRIPTION OF EVENT

A. Event

On April 28, 1996, having reduced power to 80 percent to

address Number 3 and Number 4 heater drain flow oscillations, a

decision was made at 1015 EST to remove MFP 1B (Energy Industry

Identification System [EIIS] Code P) from service to facilitate repairs to valve [EIIS] Code [SV] 1-ISV-3-0577(MFP B Feedwater Recirculation line). The Standby MFP was started and flow through the B MFP reduced. At 10:55 a.m., MFP B was manually tripped and a runback to 72 percent occurred. The runback occurred because the Balance of Plant (BOP) runback had been armed. Unit 1 had been above 85 percent power (arming setpoint) and the reset point on a turbine runback BOP pressure switch (EIIS Code 63) was designed to initiate a runback when one MFP is removed from service and the plant is above 72 percent.

After the runback, actions were taken to remove MFP 1B from service and open the above seat drain lines in accordance with SOI-2 & 3.01. Placing the MFP trip/reset switch in trip resulted in the Main Feedwater Pump Turbine (MFPT) condenser (EIIS Code COND) cooling to automatically isolate leaving only bypass cooling to the MFPT condenser. In accordance with a procedure step on the MFP shutdown process, valves (EIIS Code FCV) FCV 46-41A and -41B were opened to drain the steam and condensate from above the seats of the high and low pressure steam stop valves (EIIS Code SHV) to the MFPT condenser, and as a result of the limited amount of cooling available, the condenser pressure increased. The interaction between MFPTs

(EIIS Code TRB) 1A and 1B condenser drain tank equalizing vent line and loop seal lines resulted in a gradual loss of condenser vacuum in the MFPT 1A condenser and the eventual trip of MFP 1A at 11:09. Because the alarm and trip setpoint were set at the same point, no recovery was possible. With two MFPs tripped and the unit power above the 50 percent setpoint, the logic for main turbine trip and reactor trip was completed.

All systems responded normally to the trip. The RCS average temperature trended to 557 degrees F with no overcooling observed. All Auxiliary Feedwater (EIIS Code BA) pumps started as designed and supplied flow at 80 degrees F. All control rods dropped and were confirmed to be fully inserted. The unit was stabilized in Mode 3, and there were no abnormal radiological conditions throughout the event.

B. INOPERABLE STRUCTURES, COMPONENTS, OR SYSTEMS THAT CONTRIBUTED TO THE EVENT

No inoperable structures, components, or systems contributed to the event

C. Dates and Approximate Times of Major Occurrence

Time	Event
10:15	Decision Made to Isolate MFP B, UT the 577 Valve and Repair Due to Leak

10:27 Started Standby MFP and Began Reducing Flow
through MFP B
10:55:34.563 MFPT 1B Tripped. Feedwater Flow/Level Stabilized
in Steam Generator - Manual Trip of MFP B
10:55:34.598 Turbine Runback BOP (PS-47-13E) to Approximately
72-Percent (840 MWe)
10:57:19.687 Tavg-Tref Deviation (TS-68-2P/Q) 11:01 Entered
Administrative Operating Instruction (AOI)-37,
"Turbine Runback Response"
11:04:42.855 MFPT Condenser Drain Tank Level HI LCV-6-209,
LS-6-206A/B
11:06:30:782 MFPT Condenser Drain Tank Level LO LS-6-206 D/E
11:08:32.652 MFPT B Condenser Vacuum LO (PS-2-252E)
11:09:56.141 Turbine Trip -MFPT A and B Tripped
11:09:56.142 MFPT 1A Tripped
11:09:56.245 Turbine Trip - Auto Stop Oil Pressure LO
11:09:56.254 Reactor Trip/Turbine Trip
11:09:56.889 Steam Generator 1 Feedwater Flow HI (FS-3-35E)
and Steam Generator 4 Feedwater Flow HI
(FS-3-103E)
11:09:56.897 Steam Generator 1 Feedwater Flow HI (FS-3-35A)
11:09:58.112 Rods at Bottom
11:10:10.025 Generator 1 Reverse Power Caution

11:11 Entered Emergency Operations (E-O), "Reactor Trip or Safety Injection"

11:13 Entered Emergency Standard (ES)-0.1, "Reactor Trip Response"

11:26 Entered General Operating Instruction (GO)-2, "Reactor Startup"

D. Other Systems or Secondary Functions Affected

No other systems or secondary functions were affected by this event.

E. Method of Discovery

The turbine runback and turbine/reactor trip were annunciated in the control room.

F. Operator Actions

The operators entered and performed the steps of procedures E-O, ES-0.1, and GO-2.

The operators recognized a MFPT 1B diaphragm rupture and isolated steam seals.

G. Automatic and manual safety system responses

1A MFPT tripped.

Turbine and reactor trips and AFW start were experienced.

III. CAUSE OF EVENT

A. Immediate Cause

The turbine/reactor trip occurred upon loss of the MFP A (MFP B was secured for maintenance).

B. Root Cause

The cause of the event was the inadequacy of written communication. SOI-2 & 3.01 caused valves to be positioned in a way which resulted in the trip of MFP 1A, and subsequent turbine and reactor trips. When MFP 1B was removed from service, the turbine above seat drains were opened in accordance with procedure to prevent condensate buildup above the low pressure and high pressure steam supply valves. The procedure was appropriate for opening the above seat drain valves when the turbines are being started, however, the above seat drain valves should have remained closed when MFP 1 B was removed from service at greater than 50 percent power. The above seat drains route condensate and steam directly into the MFP 1B condenser. When MFP 1B was removed from service, the main condensate flow path through the MFP condenser tubes was automatically isolated leaving only a limited amount of flow through bypass valves. The MFP turbine drains being open directly to the MFP condenser with limited cooling medium through the tubes resulted in a pressure build-up in MFP 1B condenser. The interface between MFP 1A and 1B through the condensate drain tank resulted in a backpressure increase in

MFP 1A and the eventual trip of MFP 1A.

A contributing cause was the design of the system. The automatic isolation on the 18-inch condensate cooling lines of the non-operating main feedwater turbine pump condenser contributes to the limited condensation capability of the condenser. Manual bypass flow (1.5 inches) is limited and will compensate for steam seal flow but not stop valve leakage and continual operation through the above seat drains on the stop valves. Difficulty in maintaining vacuum in the isolated condenser had been previously recognized and a modification to tie the pump turbine condensers to the main condenser had been issued and was staged for implementation.

IV. ANALYSIS OF EVENT - ASSESSMENT OF SAFETY CONSEQUENCES

There were no safety implications to the public related to the event. With two MFPs tripped, the logic was made up for a main turbine trip and reactor trip. All systems responded normally to the trip, and AFW was automatically actuated as expected. The primary side responded as designed. All rods inserted fully into the core, and the unit was stabilized in Mode 3.

The plant responded within the design basis, and there were no abnormal radiological conditions throughout the event.

V. CORRECTIVE ACTIONS

1. Immediate Corrective Actions

Unit 1 was stabilized in Mode 3. A trip investigation was initiated.

2. Corrective Actions to Prevent Recurrence

SOI-2 & 3.01 was revised to remove the step that opens the above seat drain valves for the low pressure and high pressure stop valves when shutting down a MFPT.

A vacuum line has been provided to directly connect the MFPT condenser to the main condenser.

The MFPT condenser low vacuum alarm setpoint has been revised to provide early warning prior to trip setpoint.

(The modifications above were also addressed in LER 50-390/96015.)

VI. ADDITIONAL INFORMATION

A. Failed Components

1. Safety Train Inoperability

There were no failures that rendered a train or a safety system inoperable.

2. Component/System Failure Information

a. Method of Discovery of Each Component or System Failure:

N/A

b. Failure Mode, Mechanism, and Effect of Each Failed Component:

N/A

c. Root Cause of Failure:

N/A

d. For Failed Components With Multiple Functions, List of Systems or Secondary Functions Affected:

There were no secondary functions affected.

e. Manufacturer and Model Number of Each Failed Component:

N/A

B. Previous Similar Events LER 96009 - On February 29, 1996, condensate supply and discharge valves had been closed during maintenance on the MFPT 1B. Later, on March 13, 1996, inlet isolation valves closed which resulted in isolating the condensate flow to the condenser. With condensate isolated, the gland seal steam was no longer being condensed and was pulled into the suction of the main condenser vacuum pumps. The condenser vacuum pumps were then unable to remove non-condensables, which resulted.in the loss of vacuum to the main condenser. A manual turbine trip and a manual reactor trip resulted. Corrective action included operating procedure revisions

(SOI-2 & 3.01), verification of proper operation of automatic MFPT condenser flow switch and setpoint isolation logic, and providing a vacuum flow path from the MFPT condensers directly to the main condenser to prevent steam binding of the main condenser vacuum pumps. This modification was scheduled to be completed during a subsequent outage, prior to commercial operation.

LER96015 - On April 21, 1996, the 1A MFP tripped due to low MFPT condenser vacuum. This resulted in AFW auto start (Engineering Safety Feature [ESF] actuation). Vacuum line adjustments were in progress by assistant unit operators (AUOs) in accordance with SOI-2 & 3.01, Section 5.10, step 30) to address recurring problems with main condenser vacuum back pressure. The MFPT lines had to be throttled to prevent steam induction to the suction of the main condenser vacuum pumps. No permanent method existed for the AUOs to directly read main condenser vacuum. A contributing factor was considered to be the setpoint for the low vacuum alarm which has the same setpoint as the MFPT trip. Pump restart was authorized based on the addition of operator aids and based on briefing operating crews on the event.

B. Previous Similar Events-(Continued)

As discussed in V.2 of LER 96016, corrective actions for

both LERs addressed the MFPT low vacuum alarm and MFPT

condenser vent to the main condenser.

VII. COMMITMENTS

All actions are complete; there are no commitments.

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TVA

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John A. Scalice

Site Vice President, Watts Bar Nuclear Plant

MAY 27, 1996

U.S. Nuclear Regulatory Commission

ATTN: Document Control Desk

Washington, D.C. 20555

Gentlemen:

In the Matter of the) Docket No. 50-390

Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) - UNIT 1 FACILITY OPERATING LICENSE NPF-90

- LICENSEE EVENT REPORT (LER) 50-390/96016

Enclosed is LER 50-390/96016 which details automatic turbine and reactor

trips due to loss of both Main Feedwater Pumps.

Submittal of this report is in accordance with 10CFR 50.73(a)(2)(iv)

Sincerely

J. A. Scalice

Enclosures

cc: See page 2

cc (Enclosures):

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Enclosure

LER 50-390/96016

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